ELIZADE UNIVERSITY, ILARA-MOKIN, ONDO STATE
FACULTY OF ENGINEERING
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

SECOND SEMESTER EXAMINATION, 2017/2018 ACADEMIC SESSION

COURSE TITLE: ENGINEERING MATHEMATICS IV

COURSE CODE: GNE 316

EXAMINATION DATE:

COURSE LECTURER: PROF. O. AKINSANMI

HOD's SIGNATURE

TIME ALLOWED: <u>3 HOURS</u>

INSTRUCTIONS:

1. ANSWER <u>FIVE QUESTIONS OUT O F</u> SEVEN

2. ANSWER AT LEAST **TWO** QUESTIONS FROM EACH SECTION.

3. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAM.

4. YOU ARE **<u>NOT</u>** ALLOWED TO BORROW ANY WRITING MATERIALS DURING THE EXAMINATION.

SECTION A

Question One

(a) (i) Briefly explain the importance of Fourier series expansion in solving Engineering problems that involves periodic phenomena. [2 Marks]

    (ii) State the Dirichlet conditions for Fourier series [2 Marks]

(b) Given vector A=3i + xj +yk. Find the curl of the vector [4 Marks]

(c) If $A = x^2zi + xyj + x^2z^2 + x^2y^2z^2$, $B = yz^2i + xzj + x^2z$. Determine grad (A.B) [4Marks]

Question Two

The analytical expression for a periodic function is given as:

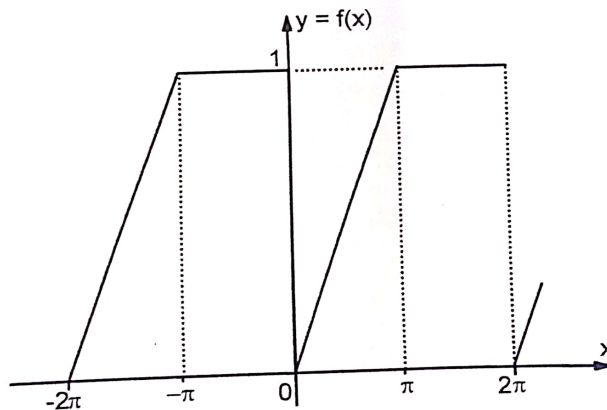$$f(x) = \begin{cases} 4, & -\pi < x < 0 \\ -4, & 0 < x < \pi \end{cases}$$

$$f(x + 2\pi) = f(x)$$

(a) Sketch the graph of the function [3Marks]

(b) Distinguish between Fourier series and Fourier transform [1 Mark]

(c) Determine the Fourier series of the function, including terms up to at least n = 5 [8 Marks]

Question Three

(a) Consider the periodic function given below,

where $f(x + 2\pi) = f(x)$

(a) Write the analytic expression for the function [3 Marks]

(b) Determine the Fourier series of the function, including terms up to at least n = 5. [8Marks]

(c) State two important application of Fourier transform in signal analysis [1 mark]

SECTION B

Question Four

(a) State three Limitations and Merits of Fourier transform in solving Engineering problem. [3 Marks]

(b) If $\phi = x^2yz^2 + xy^2z^2$. Determine grad ϕ at the point P(1,3,2)   [4Marks]

(c) Given A= 3i – 2j + 4k and B = 2i – 3j -2k. Determine the cross product of A and B and hence calculate the angle between the two vectors   [5Marks]

Question Five

(a) What are orthogonal functions? [1 Mark].Give three examples of integrals of sin (mx) and or cos (nx) that are mutually orthogonal within interval $-\pi < x < \pi$.   [3 Marks]

(b) Given that A= $(y^2 - x^2z^2)i + (x^2 + y^2)j + (x^2yzk$. Find the curl of the vector A at the point (1, 0, 2)   [4Marks]

(c) Given V=$2x^2y - xz^3$. Find the Laplacian Operator V.   [4Marks]

Question Six

(a) What is a Solenoidal vector   [2 Marks]

.(b) Given A= $(2x^2yi - 2(xy^2 + y^3z)j + 3y^2z^2k$. Determine the Grad of vector A   [5 Marks]

(c) If A= 2i – 3j + 4k and B = i – 2j -5k. Determine the cross product of the two vectors and the angle between them.   [5 Marks]

Question seven

(a) Mathematically express the vector product of two vectors A and B   [2 Marks]

(b) State the Stokes and the Divergence Theorems as applied to integral functions   [3 Marks]

(c) Using the Stokes and the Divergence Theorems, derive the differential expressions for Gauss ·, Ampere's and Faraday's Laws.   [7 Marks]